

Brookhaven National Laboratory

MEMORANDUM



Date: 07/26/95

To: D. Beavis

From: A.J. Stevens *afS*

Subj.: Additional STAR Labyrinth Calculation

This memorandum is in response to your observation that a line can be drawn from DX through the STAR labyrinth which has "1 bounce" to the entrance gate location. Fig. 1 — a copy of the crude CASIM geometry output — roughly illustrates this observation.

To evaluate any albedo contribution at the gate entrance a CASIM calculation was performed to obtain the star density at the gate entrance location although, in my opinion, the results are likely dominated by front and side wall punch-through rather than the albedo illustrated in the sketch. Before giving the result, please note that the total dose at the gate can be thought of as a sum of 3 components: (1) anything calculated by CASIM, (2) low energy neutrons in the hall interior which have been evaluated in a previous memorandum¹, and (3) low energy (evaporation) neutrons which arise from interactions in the shielding "close to" the gate location which are not transported properly by CASIM. To evaluate the third component accurately would require simulation tools that we do not possess at the moment. Van Ginneken argues² that use of the equilibrium spectrum includes (in effect) this component, which is to say that low energy dose carried by high energy (> 50 MeV) particles dominates the dose at the exit of penetrations. My own opinion is that some safety factor (conservatively something like 2) is desirable in the CASIM dose calculation to compensate for the inability to precisely determine this difficult contribution.

The star density in a concrete strip across the back (outside) of the gate position shown in Fig. 1 was calculated. The maximum azimuthally averaged star density was determined to be 1.5×10^{-10} stars/cc-p. This compares to the 500 mrem requirement³ of 2.4×10^{-9} . Although the azimuthally averaged result should be increased by about 1.3 to account for magnetic asymmetry, an order of magnitude safety factor exists.

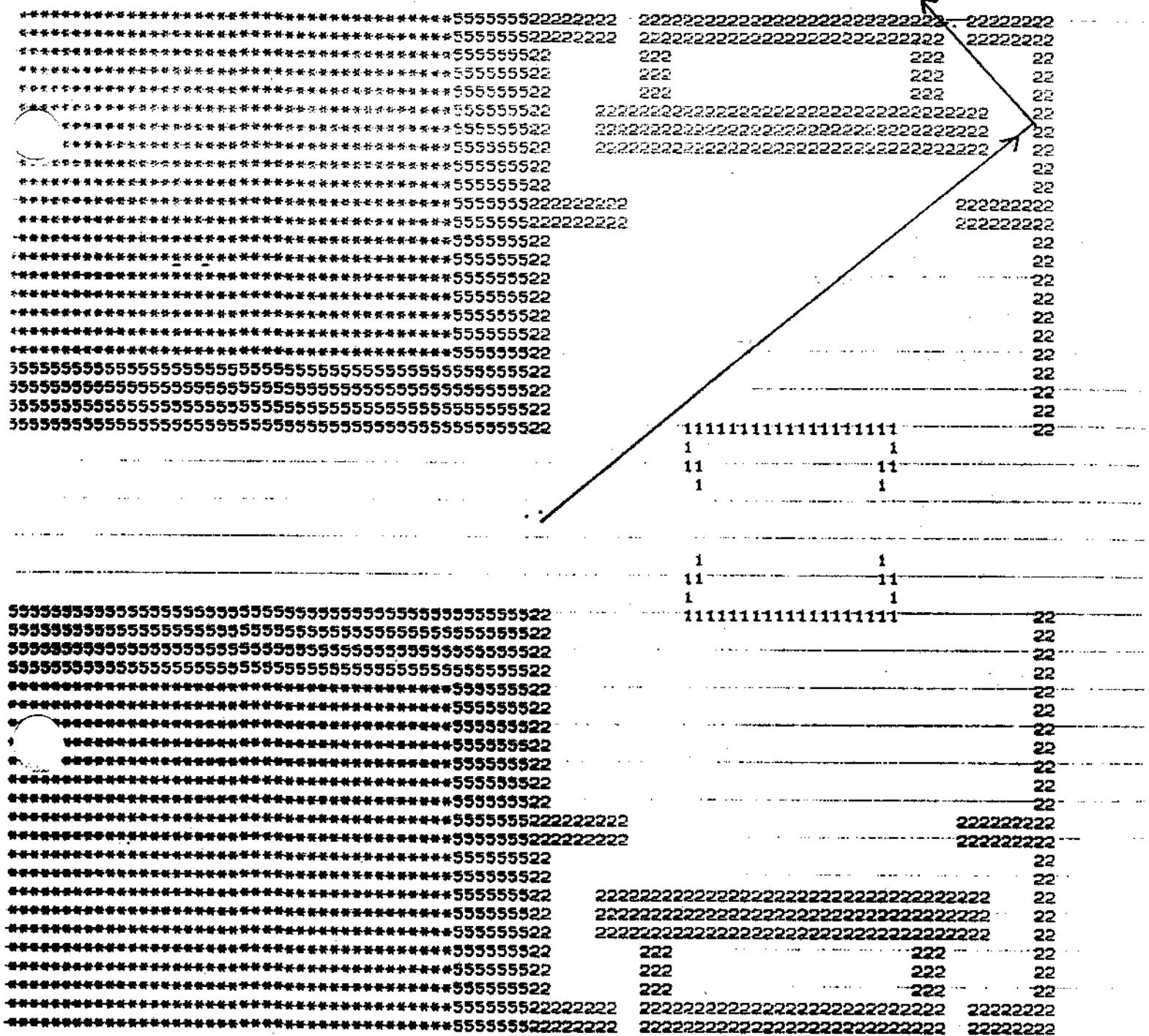
References/Footnotes

1. Memorandum from A.J. Stevens to A. Etkin and S. Musolino titled "Labyrinths in Proposed STAR Shielding Enclosure" dated 04/17/95.

2. A. Van Ginneken, "Calculation of Radiation Dose around Shielding Penetrations," FN-571, 1991.
3. The canonical design basis fault is 1.14×10^{13} 250 protons scraping on DX. This is one half of 4 times design intensity. The star density to dose conversion is 1.8×10^{-5} rem/star-cc in light concrete.

cc:

R. Brown
W. Christie
A. Etkin
S. Musolino ✓



PARAMETERS FOR MATERIAL WITH INDEX= 1

Fig. 1 CASIM Geometry Plot of the Calculation.

(The transverse and longitudinal scales are different which distorts the figure. The resolution of the figure is so coarse that the magnets do not appear.)